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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/009,521	12/11/2001	Shinichi Izuo	401479	4369

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EXAMINER

VALENTINE, DONALD R

ART UNIT PAPER NUMBER

1742

DATE MAILED: 08/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/009,521

Applicant(s)

IZUO ET AL.

Examiner

Donald R. Valentine

Art Unit

1742

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 17 and 18 is/are allowed.
- 6) ☒ Claim(s) 1,3,8 and 14 is/are rejected.
- 7) ☒ Claim(s) 2,4-7,9-13,15 and 16 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2. 6) ☐ Other: .

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1, 3, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bacon et al in view of Stengl et al.

Bacon et al show etching n-type silicon on a first surface in HF where a power source (a potentiostat) is positively connected to the silicon (substrate) and a negative terminal is connected to an electrode (21). (Column 2, lines 30-40; column 3, lines 9-25). The silicon is irradiated with light (Col. 3, lines 1-10) and

Col. 4, lines 22-40 Bacon et al disclose a meter and reference electrode, (applicants' claim 3). Bacon et al does not disclose an illumination intensity of "at least  $10\text{mW}/\text{cm}^2$ ". Nor is there shown a second surface illumination of the substrate.

As for claim 3, Bacon discloses a reference electrode and a meter, which is used to measure the potential applied to the semiconductor. (Col. 3, lines 41-42). The meter is being considered as being a "voltmeter". As for claim 8, the container (20) of Bacon et al appears to retain "a stable quality of hydrofluoric acid".

Stengl et al disclose electrochemical etching anodically connected silicon substrate in HF electrolyte, which is cathodically connected to a potential source. (See col. 3, lines 24-68). The illumination is applied to the backside, i.e. the side opposite to the side being etched by the electrolyte. This reference shows an illumination intensity of  $100\text{mW}/\text{cm}^2$ , which is considered to be "at least  $10\text{mW}/\text{cm}^2$ ", and discloses white light as a source of the illumination intensity. White light is usually considered to be that of tungsten light. See col. 4, lines 42-59.

In the absence of any unexpected results, it would be considered within the skill of the art to apply an adequate amount of illumination intensity from an

appropriate light source on the substrate of Bacon et al because both references produce porous substrates under similar conditions, regardless of which side the illumination is applied and because adequate illumination is required to effect production of holes (pores) in the silicon substrate. (See Bacon et al, col. 3, lines 1-10 and Stengl et al, col. 4, lines 42-59 and col. 5, lines 30-54).

4. Claims 1 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Foell et al.

Foell et al show an electrochemical etching “bath” (2) for holding n-type silicon substrate so that a first surface contacts an HF electrolyte. An electrode (6) is positioned in the HF. A power source is not shown, but electrodes (5) and (7) are, respectively, positive and negatively charged implying the presence of a power source. There is an illumination light source (8), which has a wavelength of 800 nm and illuminates a second side of the substrate (1). The reference does not disclose an illumination intensity of “at least 10mW/cm<sup>2</sup>”. See Figure 6 and col. 4, lines 1-55.

As for claim 14, the reference suggests controlling the current and produces trenches. See col. 3, lines 5-10 and col. 4, lines 1-14.

It would be considered within the skill of the art to select an illumination unit or controller, which would produce an appropriate amount of illumination

sufficient to enable the etching reaction to proceed because light initiated silicon etching processes require provision of sufficient illumination to enable etching to proceed in a forward manner.

***Allowable Subject Matter***

5. Claims 17-18 are allowed.
6. Claims 2, 4-7, 9-13 and 15-16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
7. The following is a statement of reasons for the indication of allowable subject matter: The references of record do not show or suggest placing a first surface of an n-type silicon substrate in touch with an electrolyte, illuminating a second surface of a silicon substrate with a first illumination intensity of at least  $10\text{mW/cm}^2$ , controlling an etching current with the illumination of the second surface to form pores or trenches in the first surface of the silicon substrate extending toward the second surface of the silicon substrate and thereafter illuminating the second surface of the silicon substrate with a second illumination intensity higher than the first illumination intensity to extend the pores or trenches laterally to connect the pores or trenches to each other.

***Conclusion***

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Sailor et al show etching silicon in HF and illuminating the backside of the substrate.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donald R. Valentine whose telephone number is 703-308-3327. The examiner can normally be reached on Monday-Friday 9:30-6:00.

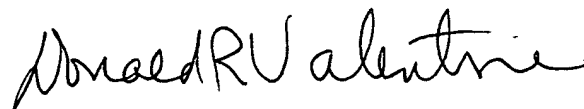
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on 703-308-1146. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

A handwritten signature in cursive script that reads "Donald R. Valentine".

Donald R. Valentine  
Primary Examiner  
Art Unit 1742

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July 25, 2003